



Methods of Arranging the System of Separate Hazardous Waste Collection and Problems of its Formation Assessment in the Municipalities of the Kaliningrad Region

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1. Ways of Arrangement of the Separate Mercury-containing Wastes (MCW) Collection System

In accordance with the Russian legislation [1.7, 6, 1.10], the arrangement of hazardous waste collection system is entrusted to the local authorities, therefore, they are the basic organizing element for the system creation. In general, such system should be created for three main sectors of hazardous waste formation: enterprises, municipal institutions and local population.

It should be mentioned that the system of separate collection and utilization in the Kaliningrad Region is operating to the more or less extent only with respect to enterprises. According to the current legislation [1.7, 1.12], enterprises should submit the reporting form 2-TP (wastes) including information on wastes formation, utilization, neutralization and disposal. According to the official reports of 257 enterprises 18.259 tons of mercury-containing wastes MCW were produced in 2011, while the major part consisted of mercury-containing lamps (MCL) constituting 77.4% (14.136 tons).

The current system of MCW collection in the Kaliningrad Region municipalities is organized at different levels and its development level is primarily related to the activities of respective municipal administrations. In some municipalities of the Kaliningrad Region (Municipality “Gur-

jevsk District” [1.4], “Town of Pionersk” [1]) the regulations have been developed and adopted to determine the procedure of MCW collection in the territory of the municipality. In the municipalities “City of Kaliningrad” and “Svetlogorsk District” the centralized MCW collection from municipal agencies has been carried out during the recent several years. Unfortunately, in other municipalities of the Kaliningrad Region no such systems have been developed.

According to the data of the only MCW utilization company “Syntez LTD,” 152,000 mercury-containing lamps were accepted for utilization from enterprises and municipal institutions in 2011.

The local population is the main consumer of energy-saving compact lamps accounting for about 70% of the total production [15]. In view of the lack of organized collection systems, the exhausted mercury-containing compact fluorescent lamps are thrown by people with garbage, causing contamination of rubbish chutes, landfills and the environment with mercury. In most municipal institutions of the Kaliningrad Region the integrated system of collection and temporary storage of mercury-containing lamps accepted from population is absent. According to the data of “Syntez LTD” in 2011 only 4 energy-saving lamps from population were accepted. Therefore, at this stage, the most relevant is to create a system of separate MCW collection from the population.

In general, separate MCW collection system in municipality shall include the following elements which are shown in Figure 1:

- Specialized licensed utilization enterprise,
- Stationary MCW collection point,
- Mobile MCW collection point,
- Site for temporary MCW storage.

The system shall include such compulsory element as the availability of a specialized enterprise for MCW utilization and assuming different combinations of elements related to the collection (reception) of wastes. The specialized utilization enterprise should implement ecologically safe demercurization technology of wastes. Otherwise, the efficiency of the separate waste collection system will be significantly decreased.

Selection of additional elements may depend on the following:

- Size (area) and population of the municipality;
- Distance to the specialized utilization enterprise;
- Availability of material and technical base in compliance with the Russian legislation (site, microbus, containers).

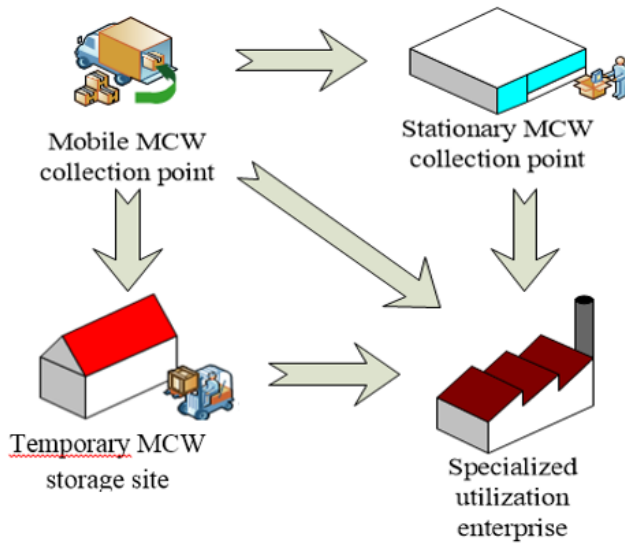


Fig. 1. The basic elements of the separate MCW collection system

Rys. 1. Podstawowe elementy systemu selektywnej zbiórki odpadów zawierających rtęć

The separate MCW collection system may include the following options or combinations of elements of separate MCW collection and utilization:

- Organization of stationary MCW collection stations with further transportation to the specialized enterprise of MCW utilization (Figure 2). The implementation is possible in small municipalities when the utilization enterprise is located at a short distance from the municipality. The distance may be about 30 km, which is favorable (economically profitable) for development of such systems and is confirmed by the results obtained during the first phase of the BAL-THAZAR project [13]. Transportation of MCW accumulated on the stationary collection point to utilization facilities can be carried out

either as containers are filled up or at least once per 5-6 months since in compliance with the Federal Law №89 “On the industrial and consumers' wastes” [7], the waste accumulation is to be carried out for the period up to 6 months.

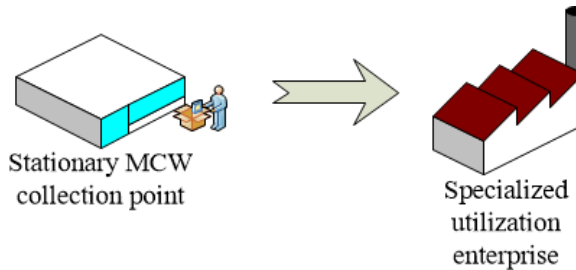


Fig. 2. Option A of creating the system of separate MCW collection and utilization

Rys. 2. Tworzenie systemu selektywnej zbiórki i utylizacji odpadów zawierających rtęć – opcja A

b) Organization of the mobile MCW collection station with further transportation of collected MCW to the specialized enterprise of MCW utilization (Figure 3). The implementation is possible in any municipalities provided that the utilization enterprise is located at a short distance (10–20 km). As a result, all collected MCW will be transported directly to the utilization enterprise.

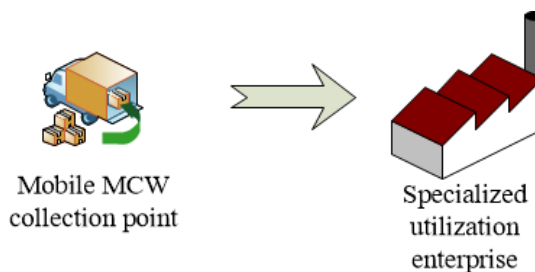


Fig. 3. Option B of creating the system of separate MCW collection and utilization

Rys. 3. Tworzenie systemu selektywnej zbiórki i utylizacji odpadów zawierających rtęć – opcja B

- c) Arrangement of the mobile MCW collection station and temporary storage sites with further transportation to the specialized enterprise of MCW utilization. The implementation is possible if the municipality occupies a large area and the utilization enterprise is located at a sufficient distance (40–50 or more kilometers). Exhausted MCW collected by ecomobile are firstly transported to the temporary storage site, while subsequent transportation of collected MCW from the temporary storage site to the utilization enterprise is carried out at least once per 5-6 months or when containers are filled up.

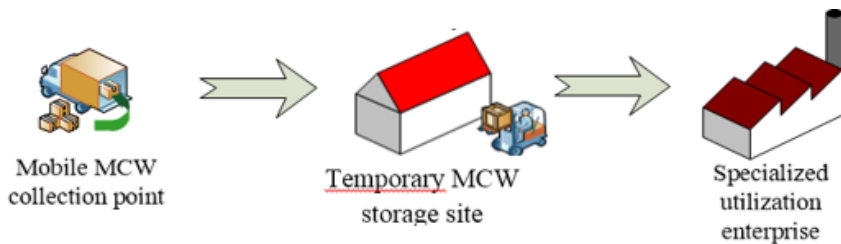


Fig. 4. Option C of creating the system of separate MCW collection and utilization

Rys. 4. Tworzenie systemu selektywnej zbiórki i utylizacji odpadów zawierających rtęć – opcja C

- d) Organization of mobile and stationary MCW collection stations with further transportation to specialized enterprise of MCW utilization. The option can be implemented in large municipalities. In this system MCW collected both at stationary and mobile collection stations are transported to the utilization enterprise when containers are filled up or once per 5–6 months.

In municipalities of the Kaliningrad Region, excluding the “City of Kaliningrad”, the options A and C of waste collection system can be implemented. This is justified by the following reasons:

- municipalities of the Kaliningrad Region belongs to small municipalities,
- using a mobile collection station in municipalities will involve to the separate waste collection not only population of municipal centers but also people of adjacent rural settlements being the part of the municipality,

- the lack of own capacities of MCW utilization. Currently only one licensed enterprise of MCW utilization is operating in the Regional center (the city of Kaliningrad) at the distance 40–50 km.

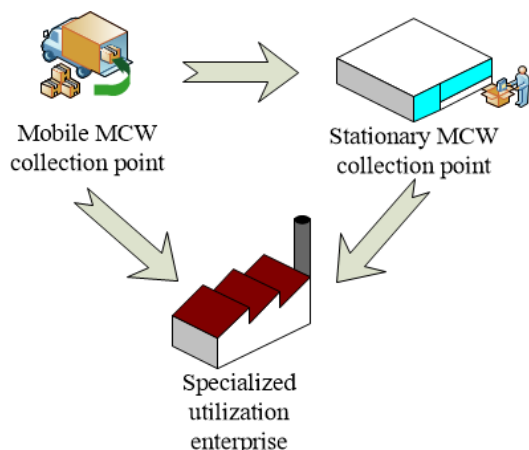


Fig. 5. Option D of creating the system of separate MCW collection and utilization

Rys. 5. Tworzenie systemu selektywnej zbiórki i utylizacji odpadów zawierających rtęć MCW – opcja D

In the municipality “City of Kaliningrad” the separate MCW collection system can be developed on the basis of options B and D. This is stipulated by the following reasons:

- this municipality belongs to large densely populated municipalities of the Kaliningrad Region with the total population of about 430 thousands of people and the area of 223 km²,
- using mobile and stationary collection stations will allow to cover the maximum number of urban population,
- the availability of own capacities for MCW utilization in the city of Kaliningrad.

Creation of the system of separate MCW collection requires to determine not only efficient and necessary elements of the system, but also mechanisms of its development. Such system can be built on the basis of the enterprises with any legal form of ownership, because in

compliance with the Russian legislation [1, 7, 6, 10] local authorities are obligated only to organize collection and transportation of solid wastes and rubbish.

In such situation in the Russian Federation in general and in the Kaliningrad Region in particular the system of separate MCW collection can be developed in two directions:

1. To adopt the necessary regulations at the level of the Russian Federation Government envisaging inclusion of costs for mercury-containing lamps utilization into the cost of a new lamp (the Law “On the hypothecation value”) and to involve manufacturers of mercury-containing lamps into the system.
Such approach will increase the cost of lamps by the value of its further collection and utilization costs and also make manufacturers of these products responsible for organization of MCW collection and utilization on the basis of funds obtained from selling the manufactured products (fluorescent and energy-saving lamps) (hypothecation value). With this approach the population will pay all expenses for MCW utilization when buying mercury-containing lamps. The experience of imposing all costs of MCW collection and utilization to manufacturers is widespread in many European countries. The main advantages of this approach include the lack of mechanism of “a direct payment” for mercury-containing wastes by the population and acceptance of such system by the public, which improves both the ecological social consciousness and the efficiency of the system implementation.
2. To fulfill the requirements of two adopted Decrees of the Russian Federation Government:
 - The Decree of the Russian Federation Government №681 of 03.09.2010 “On adoption of the Rules for treatment of industrial and municipal wastes with regard to lighting devices, electric light bulbs, improper collection, accumulation, usage, neutralization, transportation and disposal of which may cause damage to human life and health, harm to animals, plants and environment” [3],
 - The Decree of the Russian Federation Government of 13.08.2006 №491 “On adoption of the Rules of the common property maintenance in apartment house and the Rules of changing the charge for maintenance and renovation of living space in the case

of executing services and works on management, maintenance and renovation of living space of improper quality and (or) with intervals exceeding the prescribed time period” [2].

Implementation of the first legislative document entrusts the local government the powers to arrange the system of handling wastes and informing the population, legal entities and individual businessmen. The second decree imposes duties for organizing the stations for accumulation, collection of used mercury-containing lamps with subsequent transportation to specialized enterprises having licenses for collection, usage, neutralization and disposal of wastes assigned to I – IV classes of hazard, to legal entities or individual businessmen engaged in dwelling houses management. In this case the development of the separate waste collection system directly depends on the active participation of the local government in involving the above mentioned entities into the process of this system development.

The initial element of the separate MCW collection system development may be arrangement of energy-saving and fluorescent lamps reception on the basis of the enterprises (organizations) involved in the housing fund management including dwelling houses (housing and municipal services, management companies, homeowners associations, housing cooperatives and other organizations).

At the same time, the organizations carrying out the housing fund management, should fulfill the following:

- to arrange the temporary storage sites for accumulation of mercury-containing wastes,
- to provide accumulation of mercury-containing wastes in special containers located in the temporary storage sites approved by the Nature Protection Service,
- to provide recording of mercury-containing wastes,
- to inform population about the procedure of mercury-containing wastes collection,
- to provide transportation of mercury-containing wastes to licensed utilization enterprises.

To arrange the system of hazardous waste handling for legal entities (irrespective of the legal form of ownership) and individual busi-

nessmen, the following regulations should be developed and adopted by the local authorities:

- The procedure of arranging collection of used mercury-containing lamps on the territory of the municipality. The necessity of such legislative documents adoption is prescribed in the Letter by the Nature Protection Service [11].
- The Guidelines for arrangement of collection, accumulation, transportation and neutralization of used mercury-containing lamps. This document adoption is prescribed by the Government Decree №681 [3].

Financing of the system of hazardous waste collection, including MCW, at the initial stage of its development consists of two components:

- Cost of material and technical support, including equipment for hazardous waste collection,
- Cost of operation and further development of the system.

Provision of these two components is impossible without information concerning volumes of MCW formation. Therefore, the assessment of MCW formation volumes has been carried out in the municipalities of the Kaliningrad Region.

2. Estimation of Hazardous Wastes Formation Volumes in the Kaliningrad Region

Consideration of possible ways to get information concerning MCW formation volumes should be started with the identification of the main sources of the waste formation and the existing methods of their recording. As has been already noted before, in general, three main sectors of MCW formation may be distinguished: industrial enterprises, municipal organizations and local population. While for the first two sectors the requirements to recording and further treatment of wastes have been more or less legislatively determined (recording and reporting in the form 2-TP for industrial enterprises and recording for budget institutions), in the case of local population neither recording is carried out.

Taking into account the fact, that the local population is the main consumer of compact energy-saving lamps, constituting the majority of imported mercury-containing lamps, and in view of the lack of any infor-

mation on the volumes of MCW formation from this sector, the assessment of MCW production by the local population is required to develop the system of MCW separate collection and treatment in the Kaliningrad Region. The absence of any reliable sources of information on the volumes of MCW production by the local population in the municipalities of the Kaliningrad Region has stipulated the necessity to develop and apply a variety of methods for the estimation. Application of several approaches, based on different data, allowed to compare the obtained results and to improve their reliability and the quality. The estimated values were used to calculate prices for MCW utilization, to determine the number of containers required for MCW collection, and to assess the production capacities needed for utilization of MCW in the Kaliningrad Region.

2.1. First Method of Estimation

The approach already tested earlier [13], has been taken as the basis of the first method. It was based on the amount of annually imported mercury-containing lamps according to the customs data recalculated by the population size in each municipality relative to the total population of the region. This method has been modified, and, instead of the average annual amount of imported mercury-containing lamps in the Kaliningrad Region according to the customs data, the amount of mercury-containing lamps, sold in retail networks of the Kaliningrad region in 2011 was taken. This allowed to estimate the actual amount of currently used mercury-containing lamps and to assess the potential volumes of MCW formed.

Therefore, the first approach with modifications made is as follows:

1. The volume of MCW formation on the entire territory of the Kaliningrad region has been taken equal to the volume of mercury-containing lamps sold in retail networks of the Kaliningrad Region during 2011. This information was based on the surveys of the mercury-containing lamps sales volume fulfilled by the only licensed MCW utilization enterprise in the Kaliningrad Region “Sintez LTD” at the large retail networks of the Region in 2011. This volume constituted about 1.5 mln. lamps. On the basis of the positive experience of the project first phase and taking into account the reduction in turnover of other mercury-containing devices used by population (thermometers, etc.), it is possible to conclude that used mercury-containing lamps constitute the basis of MCW.

2. In calculation of MCW formation volumes for each municipality, it was assumed that the proportion of MCW in each municipality is equal to the proportion of its population against the total population of the Kaliningrad Region as at 01.01.2011 [9] (Formula(1)).

$$N = \frac{V_2 \cdot P_m}{P_{ko}} \quad (1)$$

where:

V_2 – number of mercury-containing lamps sold in large retail networks of the Kaliningrad Region in 2011, pcs,

P_m – population of the municipality, persons,

P_{ko} – total population of the Kaliningrad Region, persons.

The calculations show that the greatest amount of MCW is formed in the regional center of the Kaliningrad Region, i.e. in the City of Kaliningrad (686.9 thousand pcs/year). The disadvantage of this method is the impossibility of accounting the amount of mercury-containing lamps purchased by the local population before 2011.

2.2. Second Method of Estimation

This method is based on the analysis of the information obtained by questioning of the local population fulfilled in the framework of the information campaign during the second phase of BALTHAZAR project in the pilot municipalities. One of the blocks of the questionnaire was devoted to the study of the MCW formation volumes in the dwelling sector of municipalities. This allowed to assess the actual amount of mercury-containing lamps currently used by the population of the Kaliningrad Region by the example of the pilot municipalities.

Calculation of the potential volume of mercury-containing lamps was carried out using the method based on the number of mercury-containing lamps assessed on the basis of the extent of mercury-containing lamps usage by respondents against the total number of lamps reported by them per one family taking into account the total population of the municipality (formula (2)):

$$\text{ПОРСЛ} = \frac{\text{ОКЛ} \cdot \text{ПРСЛ} \cdot \text{ЧН}}{100 \cdot \text{КОР} \cdot \text{КЧ}}, \quad (2)$$

where:

ПОРСЛ – the potential volume of mercury-containing lamps, pcs.

ОКЛ – total number of lamps of all types, pcs.;

КОР – number of respondents, persons;

ПРСЛ – percentage of usage of mercury-containing lamps by respondents;

КЧ – average number of persons per one family;

ЧН – total population of the municipality, persons.

The obtained parameters and potential volumes of mercury-containing lamps used by population of the pilot municipalities are given in Table 1.

Table 1. Potential number of mercury-containing lamps among the population of the pilot municipalities

Tabela. 1. Potencjalna liczba lamp zawierających rtęć wśród ludności gmin pilotażowych

Municipality	Parameter in formula (1)					
	ПОРСЛ	ОКЛ*	ПРСЛ*	ЧН**	КОР*	КЧ
«Svetlogorsk District»	24.8 thous.	16284	43.9%	14900	1074	4
«Zelenogradsk District»	67.0 thous.	26551	58.9%	32200	1880	4
«City of Kaliningrad»	932.0 thous.	22419	49.8%	43110 0	1291	4

Note:

* – based on the data obtained from questionnaires

** – based on the data from “Statistical Bulletin «Kaliningrad Region in Figures in 2011»

It should be mentioned that this method envisages assessment of the number of lamps already available at the given moment taking into account the lamps acquired by the local population both in 2011 and before, i.e. so-called "cumulative" effect is considered.

The method applied in calculation of the available number of mercury-containing lamps (MCL) available among the population in the pilot municipalities on the basis of the questionnaire survey data allows to calculate this parameter for other municipalities of the Kaliningrad Region, and therefore, to calculate the amount of mercury-containing lamps available among the total population of the Kaliningrad Region. For this purpose it is necessary to calculate the average number of mercury-containing lamps per one person, living in the specified municipality on the basis of the following formula (3):

$$Q = \frac{N}{P} \quad (3)$$

where:

Q – average number of MCL per one person;

N – number of MCL available among the population;

P – the total population.

On the basis of the data obtained from the questionnaire survey of the local population, the above parameter values are presented by the pilot municipalities in Table 2.

Table 2. Average number of mercury-containing lamps per one person in the pilot municipalities of the Kaliningrad Region

Tabela 2. Średnia liczba lamp zawierających rtęć na osobę w gminach pilotażowych Obwodu Kaliningradzkiego

Parameter	«Svetlogorsk District»	«Zelenogradsk District»	«City of Kaliningrad»
Average number of MCL per one person	1.67	2.08	2.16

Since all settlements of the Kaliningrad Region, excluding the City of Kaliningrad, represents small municipalities, the above parameter may be calculated on the basis of its average value obtained for two pilot municipalities assigned to small municipalities of the Kaliningrad Region (the municipalities “Zelenogradsk District” and “Svetlogorsk District”). Thus, an average number of MCL per one person for small municipalities

of the Kaliningrad Region constitutes 1.87. On the basis of the value obtained, the amount of MCL available among population of other municipalities of the Kaliningrad Region has been calculated.

Therefore, the total amount of MCL available among the population of the Kaliningrad Region constitutes 1,889,219 pcs, while 50% of the total amount occurred in the city of Kaliningrad.

In addition, the calculation of the potential volumes of formed mercury-containing wastes per month was carried out on the basis of the questionnaire survey data was carried out taking into account the information on periodicity of mercury-containing lamps replacement by respondents in the pilot municipalities. Considering the fact that each long period includes several shorter periods, in estimation of the wastes volume it is necessary to take into account not only volumes of mercury-containing wastes formed during a given time interval but also the volumes of MCW formed during shorter intervals within the considered time period. For example, if the volume of MCW formation during half a year is estimated, in addition to consideration of percentage of residents replacing lamps every six months, it is necessary to take into account information, obtained during calculation of mercury-containing waste formation over the months and quarters constituting this half-year period. Therefore, the formula for estimation of formed mercury-containing wastes on the basis of the data on periodicity of mercury-containing lamps replacement during each period may be as follows (formula (4)):

$$OPCO_M = \frac{ЧН}{12 \cdot КЧ} \cdot \sum_{i=1}^n \frac{ПР_{\text{период}_i} \cdot ЧП \cdot q_i}{100}, \quad (4)$$

where:

OPCO_M – potential volume of formed mercury-containing wastes per month, pcs.,

ЧН – total population of the municipality, persons,

КЧ – average number of persons per one family,

ПР_{период_i} – percentage of respondents replacing lamps during the i-th period,

ЧП_i – number of i-th periods within one calendar year,

n – number of considered periods of the year (equal to 4),

q_i – average number of MCL replaced by the respondent during the i -th period.

The obtained values were used in calculation of the necessary number of containers and development of the traffic schedule of the mobile collection station for the municipality “Svetlogorsk District”.

It should be mentioned that, in general, both methods give sufficiently similar results (Table 3). The difference in calculated values for the small municipalities of the Kaliningrad Region is about 8%. Taking into account the fact that the second method considers not only MCL purchased by population in 2011, but also MCL, purchased by them earlier, the following conclusion can be made: the value of this difference includes not only inaccuracy in calculations of these two methods, but also the number of lamps in percentage, accumulated by the population for the previous period, being the evidence of sufficiently high level of the obtained data reliability.

Table 3. Amount of mercury-containing lamps calculated with two methods

Tabela 3. Ilość lamp zawierających rtęć obliczona dwoma metodami

Municipality	First method	Second method
City of Kaliningrad	686.902	931.176
Pilot municipalities of the Kaliningrad Region		
Zelenogradsk District	51.307	66.976
Svetlogorsk District	23.741	24.883
Some other municipalities of the Kaliningrad Region		
Baltijsk District	57.521	67.507
Town of Mamonovo	12.747	14.960
Neman District	32.027	37.587
Chernyahovsk District	82.537	96.866

There are other methods, for example, based on the data concerning the operational life of the lamp. However, the conditions of energy saving lamps operation may considerably reduces their operational life

and do not allow to use such methods since they underestimate the value of the MCW formation volumes.

For the purpose of more efficient assessment the MCW formation volumes and to provide combining the municipalities in groups on the basis of several criteria (not only one), in future it is necessary to take into account not only such parameter as municipality size (population), but also such parameters as per capital income, average living space per one person and other social and economic parameters. However, the proposed methods allow to assess the potential volume of MCW formation not only at the initial stage of the system creation, but also can be used in its future development.

The results of the proposed methods of assessment of the MCW formation volumes became the basis for the calculation of the costs of the system operation, which can be provided both by consumers of mercury-containing lamps (the local population) and budgetary funds of the municipalities. At the initial stage of arrangement of separate collection and utilization of fluorescent lamps, the financing can be entrusted to the local authorities because at this stage the necessity to inform the population and its involvement in the separate collection of mercury-containing lamps is a priority.

On the basis of the current regulations of the Government [3, 2] the procedure of payment by the local population for MCW collection and handling can be implemented on the basis of the contract between the legal entity or individual businessman engaged in housing management, and residents for introducing the tariff for MCW collection and handling. This tariff should include the cost of MCW collection and transportation and cost of utilization of one fluorescent lamp. For this purpose the calculation of prime cost of utilization on the basis of the data on MCW formation per month, operational costs for utilization of one fluorescent lamp and population size in the municipality was carried out (formula (5)).

$$T = \frac{V_M \cdot C}{P} \quad (5)$$

where:

T – prime cost of MCW utilization per month per one person, rubles,

V_M – average number of MCL replaced by the local population of the municipality per month, pcs,

C – cost of utilization of one mercury-containing lamp, rubles,

P – population of the municipality, persons.

Currently in the Kaliningrad Region “Syntez LTD” company accepts for utilization used fluorescent and energy-saving lamps from the population and enterprises. The utilization cost is 15 rubles per one lamp in a cardboard (factory) box and 12 rubles per one lamp in a container [14].

Earlier the estimation of utilization value of one mercury-containing lamp and operating costs during 10 years operation of demercurization unit “Ecotrom-2”, purchased within the framework of the first stage of the project has been made [13]. The calculation results showed that the utilization cost of one mercury-containing lamp is 6.3 rubles (0.15 Euro). Since the calculation of the utilization cost was made in 2010, it is necessary to introduce a correction taking in account the rate of inflation in Russia in 2011. According to the data of the Federal State Committee for Statistics [9] the rate of inflation in 2011 amounted to 6.1%. Thus, the utilization cost of one lamp in 2012 adjusted for inflation is 6.68 rubles.

Therefore, the monthly tariff for utilization of mercury-containing lamps for population of the pilot municipalities of the Kaliningrad Region may constitute 1.14 and 0.51 on average for utilization of mercury-containing lamps by “Syntez LTD” and with possible use of demercurization unit, respectively (when this cost may be reduced about twice).

Taking into account the experience of the European countries (Germany) the operating cost (payment for collection and transportation) may be included into a common tariff for the transportation and utilization of solid wastes paid by population, while the expenses for demercurization may be imposed on the local authorities. In such system the responsibility for utilization of hazardous wastes is imposed not only on the local authorities, but on the population dealing with hazardous wastes.

The proposed system of arrangement of separate MCW collection at the municipal level and methods of assessment of the MCW formation volume can be implemented regardless of hazardous waste type and the ongoing changes in the Russian Federal legislation and respective regulations in the field of hazardous waste management.

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Metody organizacji systemu selektywnej zbiórki odpadów niebezpiecznych i problemy z oceną jego powstawania w gminach Obwodu Kaliningradzkiego

Streszczenie

Obecnie problem rozwoju systemu selektywnej zbiórki i dalszej utylizacji różnego rodzajów odpadów niebezpiecznych stał się jeszcze bardziej aktualny. Spowodowane jest to tym, że odpady te składowane na składowiskach wraz odpadami komunalnymi, mogą stanowić zagrożenie, nie tylko dla środowiska, ale również dla zdrowia ludzkiego. Dlatego też, obecnie w większości krajów rozwiniętych (także w Rosji) konieczna jest segregacja tworzonych odpadów i ich utylizacja różnymi metodami, w celu zmniejszenia ich negatywnego wpływu i włączenia ich do obrotu gospodarczego. Jest to szczególnie istotne w świetle rosnącej produkcji niebezpiecznych odpadów przez miejscową ludność, związanej przede wszystkim z rozwojem urządzeń technicznych oraz ich wdrażaniem w codziennej działalności człowieka. Najbardziej uderzającym przykładem jest utylizacja takich odpadów niebezpiecznych, jak np. odpady zawierające rtęć. Obecnie w naszym kraju, szczególną uwagę zwraca się na problem selektywnej zbiórki i dalszego zagospodarowania tego typu odpadów, zwłaszcza lamp zawierających rtęć. Jest to przede wszystkim związane z szerokim zastosowaniem tych lamp we wszystkich sferach działalności gospodarczej, również przez ludność lokalną. Co więcej, w Rosji, zgodnie z federalną ustawą № 261 [8] i aktem Służby Ochrony Przyrody [11], do 2014 r. wszystkie rodzaje żarówek powinny zostać wycofane z użytku, co będzie prowadzić nieuchronnie do zwiększenia ilości odpadów zawierających rtęć. Dlatego też, w wielu regionach Rosji, w tym także w Obwodzie Kaliningradzkim, zostały podjęte środki w celu zapewnienia selektywnej zbiórki i dalszej utylizacji odpadów zawierających rtęć, także wytwarzanych przez ludność lokalną.

Słowa kluczowe: odpady niebezpieczne, system selektywnej zbiórki odpadów, lampy zawierające rtęć

Key words: hazardous wastes, system of separate waste collection, mercury-containing lamps